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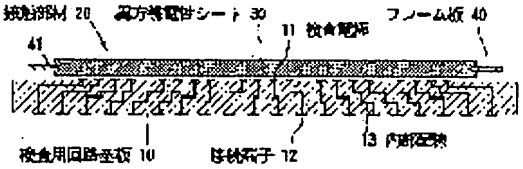
(54) PROBE EQUIPMENT FOR WAFER TESTING

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a compact probe equipment for a wafer testing with a low manufacturing cost not giving damages to an electrode under test, capable of surely achieving an electrical connection to each of electrodes under test even for a wafer wherein a large number of electrodes are arranged in high density and holding a satisfactory electrical connection state in stability even when repeatedly used.



SOLUTION: The equipment comprises a testing circuit board wherein a large number of testing electrodes are entirely formed thereon according to a pattern corresponding to a pattern of integrated circuit electrodes on the wafer being subjected to test, and a contact member contacting to the integrated circuit electrodes on the wafer arranged on one side of the testing circuit board. The contacting member includes an anisotropically conductive sheet wherein at least a portion which contacts to the electrodes on the wafer contains conductive grains in the state of orienting in a thickness direction in an insulating elastic high molecular material.

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* NOTICES *

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2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the wafer checking probe equipment used in order to conduct each electric inspection of the integrated circuit concerned about the wafer with which two or more integrated circuits were formed.
[0002]
[Description of the Prior Art] In recent years, instead of the mounting method by wire bonding, the TAB mounting method and the flip chip mounting method are widely used as an approach of mounting a semiconductor chip, with the request of a miniaturization of semiconductor integrated circuit equipment. And in the front face of the semiconductor chip with which such a mounting method is presented, the letter electrode of a projection (bump) which consists of gold or solder (lead-tin alloy) is formed on the flat pad electrode. This letter electrode of a projection is formed on a pad electrode in the state of the wafer with which many integrated circuits used as a semiconductor chip were usually formed, and the semiconductor chip which has a letter electrode of a projection is obtained by cutting this wafer after that.
[0003] On the other hand, in order to make the latent defect of the semiconductor chip concerned discover in electric inspection of a semiconductor chip, the burn-in (Burn-in) trial which inspects the electrical characteristics where a semiconductor chip is heated to an elevated temperature is performed. since [appropriate] it is alike, a semiconductor chip is minute and the handling is inconvenient, in order to conduct electric inspection of the semiconductor chip concerned individually, long time amount is required and inspection cost becomes high fairly. From such a reason, the WLBI (Wafer Level Burn-in) trial which inspects the electrical characteristics of two or more semiconductor chips in the state of a wafer attracts attention. Moreover, in recently, if the technique of manufacturing CSP (ChipScale Package) which is micro semiconductor integrated circuit equipment in the state of a wafer is developed and a WLBI trial can be performed about such CSP, it is very advantageous on manufacture.
[0004] It **, and in order to perform electrical installation of the integrated circuit and circuit tester in the wafer which is a subject of examination in electric inspection of such a wafer, the probe equipment with which the inspection probe was arranged corresponding to the inspected electrode of the integrated circuit concerned is used. As this probe equipment, the thing which comes to arrange the inspection probe which consists of a pin or a blade is known conventionally. And if the thing which comes to arrange an inspection probe as wafer checking probe equipment corresponding to all the inspected electrodes in a wafer is used, since it will become possible to conduct electric inspection of all the integrated circuits in a wafer by one inspection processing, compaction of inspection time amount and reduction-ization of inspection cost can be attained.
[0005] since it is necessary to arrange many inspection probes very much in order [appropriate] are alike and to produce such wafer checking probe equipment, the wafer checking probe equipment concerned will become large-sized and very expensive, and when the pitch of an inspected electrode is still smaller, it becomes difficult to produce wafer checking probe equipment itself. Moreover, since big

curvature has usually arisen, and variation is in the protrusion height of the letter electrode of a projection concerned especially when the inspected electrode of the wafer which is a subject of examination is a letter electrode of a projection, it is difficult for the wafer in which the integrated circuit was formed to contact each of the inspection probe of probe equipment stably and certainly to the inspected electrode of a large number in a wafer in practice. Furthermore, when the letter electrode of a projection in a wafer is formed with solder, after having been heated by the elevated temperature, since a degree of hardness will become fairly low, when the letter electrode of a projection concerned is heated by the elevated temperature in the condition of having been pressurized by the inspection probe which consists of a pin or a blade, it has the problem that the letter electrode of a projection concerned deforms or breaks.

[0006] As wafer checking probe equipment for conducting electric inspection of the wafer with which the integrated circuit was formed, in order to solve such a problem The checking circuit board which has the inspection electrode of a large number formed in the whole surface according to the pattern corresponding to the pattern of the inspected electrode of the wafer which is a subject of examination, On the resin sheet which consists of fluororesin etc. The wafer checking probe equipment which has the sheet-like connectors (for example, trade name made from GOAANDOASOSHIETSU "GORE Mate" etc.) with which it comes to arrange the metallic conductor of a large number penetrated and extended in the thickness direction in the shape of a grid is proposed. According to such a configuration, it compares with the wafer checking probe equipment with which it comes to arrange many inspection probes which consist of a pin or a blade. It is small and it is possible for wafer checking probe equipment with a small manufacturing cost to be obtained, and to conduct electric inspection of all the integrated circuits in a wafer by one inspection processing. Moreover, it becomes possible to attain stable electrical installation, without doing damage to the letter electrode of a projection concerned to many letter electrodes of a projection, since the resin sheet in a sheet-like connector has flexibility.

[0007] However, it sets to such wafer checking probe equipment. In order to attain stable electrical installation to all the inspected electrodes in a wafer Since fairly big welding pressure is required and the metallic conductor of a sheet-like connector moreover is not an elastic body, When were heated by the elevated temperature in the condition of it having been pressurized with the inspected electrode of the wafer which is a subject of examination, or having been pressurized and the sheet-like connector concerned is repeated and used as a result of the metallic conductor concerned deforming or breaking, a good electrical installation condition is not acquired. Therefore, whenever it inspects one wafer, a sheet-like connector must be exchanged for a new thing and there is a problem that inspection cost becomes high, after all. Such a problem especially is remarkable when an inspected electrode is a letter electrode of a projection.

[0008]

[Problem(s) to be Solved by the Invention] This invention is made based on the above situations. The purpose In the wafer checking probe equipment for conducting each electric inspection of the integrated circuit concerned about the wafer with which the integrated circuit was formed Also about the wafer with which damage was not done to an inspected electrode and many inspected electrodes have been arranged at high density The electrical installation to each of the inspected electrode concerned can be attained certainly, and an electrical installation condition good also when it is moreover repeatedly used over many times is maintained by stability, and it is still smaller and is in offering wafer checking probe equipment with a small manufacturing cost.

[0009]

[Means for Solving the Problem] The wafer checking probe equipment of this invention is wafer checking probe equipment for conducting each electric inspection of the integrated circuit concerned about the wafer with which two or more integrated circuits which have many electrodes, respectively were formed. The checking circuit board by which many inspection electrodes were formed in the whole surface according to the pattern corresponding to the pattern of the electrode of the integrated circuit in the wafer which is a subject of examination, It comes to have the contact-carrying member contacted by the electrode of the integrated circuit in said wafer arranged on the whole surface of this checking circuit

board. Said contact-carrying member The part contacted at least by the electrode in said wafer is characterized by being constituted in an insulating elastic high polymer with the anisotropic conductive sheet which it comes to contain after the conductive particle has carried out orientation in the thickness direction.

[0010] The wafer checking probe equipment of this invention is especially useful when the electrode in the wafer which is a subject of examination is a letter electrode of a projection. Moreover, said anisotropic conductive sheet may consist of the track formation section of a large number extended in the thickness direction which the conductive particle contained densely, and the insulating section which intervened among these track formation sections in the wafer checking probe equipment of this invention. Moreover, the conductive rigid layer may be formed in the front face of the track formation section in an anisotropic conductive sheet, and, as for such a conductive rigid layer, it is desirable that they are a metal layer or a conductive organic material layer.

[0011] Moreover, in the anisotropic conductive sheet of this invention, said contact-carrying member has the frame plate with which opening was formed, and, as for said anisotropic conductive sheet, it is desirable to be arranged after the periphery section of the anisotropic conductive sheet concerned has been fixed to opening of said frame plate by the opening edge of the frame plate concerned. In such wafer checking probe equipment, it is desirable that two or more openings are formed in said frame plate, and the anisotropic conductive sheet is arranged at each of the opening concerned, and opening of said frame plate has the still more desirable thing in the wafer which is a subject of examination currently formed for every integrated circuit. Moreover, it is desirable that the line coefficients of thermal expansion of the frame plate in said contact-carrying member are below 1.5x10-4/K.

[0012]

[Function] Since the part in contact with the inspected electrode of the wafer in a contact-carrying member is constituted by the anisotropic conductive sheet which has elasticity according to the above-mentioned configuration, the inspected electrode concerned is not damaged even if heated in the condition of it having been pressurized by the contact-carrying member or having been pressurized. And since elastic deformation of it is carried out in the thickness direction when an anisotropic conductive sheet is pressurized by the wafer, it can attain stably and certainly the electrical installation to each of the inspected electrode concerned also about the wafer with which the letter electrode of a projection of a large number which project also about the wafer which big curvature produced when an inspected electrode is a letter electrode of a projection, and have variation in height has been arranged by high density. Moreover, even if an anisotropic conductive sheet is heated by the elevated temperature in the condition of it having been pressurized with the inspected electrode or having been pressurized, in order that it may not break down easily, also when it is repeatedly used over many times, a good electrical installation condition is maintained by stability. Moreover, since it becomes unnecessary to arrange many inspection probes which consist of a pin or a blade, reduction-ization of a manufacturing cost can be attained, the checking circuit board and a contact-carrying member have small thickness respectively, and since stable electrical installation is moreover obtained with small welding pressure and a thing large-sized as a pressurization device becomes unnecessary, the miniaturization of the whole wafer test equipment can be attained.

[0013]

[Embodiment of the Invention] Hereafter, the wafer checking probe equipment of this invention is explained to a detail.

[Gestalt of the 1st operation] Drawing 1 is the sectional view for explanation showing the configuration of the wafer checking probe equipment concerning the gestalt of operation of the 1st of this invention. This wafer checking probe equipment is constituted by the checking circuit board 10 by which many inspection electrodes 11 have been arranged at the whole surface (it sets to drawing and is a top face) according to the pattern corresponding to the pattern of the letter electrode of a projection which is an inspected electrode in the wafer which is a subject of examination, and the contact-carrying member 20 contacted by the wafer which has been arranged on the whole surface of this checking circuit board 10, and which is a subject of examination.

[0014] the checking circuit board 10 -- on the other hand (it sets to drawing and is an inferior surface of tongue) -- **** -- many connection terminals 12 connected to a circuit tester are formed according to the proper pattern, and each of these connection terminals 12 is electrically connected to each of the inspection electrode 11 through the internal wiring 13 in the checking circuit board 10 concerned. As a base material of the checking circuit board 10, especially if it has thermal resistance, it will not be limited. The various things usually used as a substrate ingredient of a printed circuit board can be used. As the example A glass fiber reinforcement mold epoxy resin, glass fiber reinforcement mold polyimide resin, Glass fiber reinforcement mold bismaleimide triazine resin, polyimide resin, Although resin ingredients, such as an aramid non-woven fabric reinforcement mold epoxy resin, aramid non-woven fabric reinforcement mold polyimide resin, and aramid non-woven fabric reinforcement mold bismaleimide triazine resin, a ceramic ingredient, a glass ingredient, metal core materials, etc. can be mentioned It is desirable that the line coefficient of thermal expansion of the ingredient with which the line coefficient of thermal expansion constitutes the wafer which is a subject of examination uses an EQC or the approximated thing. Especially when it is what a wafer becomes from silicon, specifically, it is desirable that a line coefficient of thermal expansion uses the thing of 1x10-7 - 1x10-4/K below 1.5x10-4/K.

[0015] The contact-carrying member 20 is constituted by the frame plate 40 of the shape of a ring by which the circular opening 41 was formed in the center section except the periphery section, and the anisotropic conductive sheet 30 of the flat-surface round shape which has conductivity in the thickness direction, and this anisotropic conductive sheet 30 is arranged after the periphery section of the anisotropic conductive sheet 30 concerned has been fixed to the opening 41 of the frame plate 40 by the opening edge of the frame plate 40 concerned. An anisotropic conductive sheet 30 contains and consists of conditions are in the condition which carried out orientation so that the conductive particle P might be located in a line in the thickness direction of the anisotropic conductive sheet 30 concerned, and distributed in the direction of a field in the base material which consists of an insulating elastic high polymer, as a conductive particle contains and is constituted in the thickness direction in an insulating elastic high polymer, where orientation is carried out, it expands to drawing 2 and this example shows.

[0016] As for the thickness of the anisotropic conductive sheet 30, it is desirable that it is 0.1-1mm, and it is 0.15-0.5mm more preferably. In the condition that the anisotropic conductive sheet 30 concerned was pressurized by using the anisotropic conductive sheet 30 which has such thickness by the letter electrode of a projection of a wafer, while the variation in the protrusion height of the letter electrode of a projection concerned is absorbed and good electrical installation is obtained much more certainly, the adjoining letter of projection inter-electrode necessary insulation is attained certainly. Moreover, although the thickness of the frame plate 40 will not be especially limited if it can hold the anisotropic conductive sheet 30 while the configuration is maintained, it is 0.1-0.25mm preferably 0.03-1mm, for example.

[0017] The heat-resistant high polymer of the elastic high polymer which constitutes the anisotropic conductive sheet 30 which has the structure of cross linkage is desirable. As a high polymer formation ingredient of hardenability which can be used in order to obtain this crosslinked polymer matter Various things can be used. As the example Silicone rubber, polybutadiene rubber, natural rubber, polyisoprene rubber, Conjugated diene system rubber and these hydrogenation objects, such as styrene-butadiene copolymer rubber and acrylonitrile-butadiene copolymer rubber, Block-copolymer rubber and these hydrogenation objects, such as styrene-butadiene-diene block-copolymer rubber and a styrene-isoprene block copolymer, A chloroprene, polyurethane rubber, polyester system rubber, epichlorohydrin rubber, ethylene-propylene copolymer rubber, ethylene-propylene-diene copolymer rubber, elasticity liquefied epoxy rubber, etc. are mentioned. In these, silicone rubber is desirable in respect of fabrication nature and an electrical property.

[0018] As silicone rubber, what constructed for it the bridge or condensed liquefied silicone rubber is desirable. For liquefied silicone rubber, the viscosity is 105 at strain rate 10-1sec. The following [a poise] may be desirable and may be any, such as a thing of a condensation mold, a thing of an addition mold, and a thing containing a vinyl group or hydroxyl. Specifically, dimethyl silicone crude rubber,

methylvinyl silicone crude rubber, methylphenyl vinyl silicone crude rubber, etc. can be mentioned.
[0019] The liquefied silicone rubber (vinyl group content poly dimethylsiloxane) which contains a vinyl group in these is usually obtained in dimethyldichlorosilane or dimethyl dialkoxysilane by performing hydrolysis and judgment carrying out a condensation reaction, for example, according to the repeat of dissolution-precipitate succeedingly to the bottom of existence of dimethyl vinyl chlorosilicane or dimethyl vinyl alkoxysilane. Moreover, the liquefied silicone rubber which contains a vinyl group in both ends carries out the anionic polymerization of cyclosiloxane like octamethylcyclotetrasiloxane to the bottom of existence of a catalyst, and is obtained by choosing suitably other reaction conditions (for example, the amount of cyclosiloxane and the amount of a terminator), using for example, a dimethyl divinyl siloxane as a terminator. Here, as a catalyst of anionic polymerization, alkali or these SHIRANO rate solutions, such as tetramethylammonium hydroxide and hydroxylation n-butyl phosphonium, etc. can be used, and reaction temperature is 80-130 degrees C. Such vinyl group content poly dimethylsiloxane is the molecular weight Mw (standard polystyrene equivalent weight average molecular weight is said.). It is below the same. It is desirable that it is the thing of 10000-40000. moreover, the molecular-weight-distribution characteristic (the ratio of the standard polystyrene equivalent weight mean molecular weight Mw and the standard polystyrene conversion number average molecular weight Mn -- the value of Mw/Mn is said.) from a heat-resistant viewpoint of the anisotropic conductive sheet 30 obtained It is below the same. Two or less thing is desirable.
[0020] On the other hand, the liquefied silicone rubber (hydroxyl content poly dimethylsiloxane) containing hydroxyl is usually obtained in dimethyldichlorosilane or dimethyl dialkoxysilane by performing hydrolysis and judgment carrying out a condensation reaction, for example, according to the repeat of dissolution-precipitate succeedingly to the bottom of existence of dimethyl hydronalium chlorosilicane or dimethyl hydronalium alkoxysilane. Moreover, the anionic polymerization of the cyclosiloxane is carried out to the bottom of existence of a catalyst, and it is obtained also by choosing suitably other reaction conditions (for example, the amount of cyclosiloxane and the amount of a terminator), using for example, dimethyl hydronalium chlorosilicane, methyl dihydrochlorosilicane, or dimethyl hydronalium alkoxysilane as a terminator. Here, as a catalyst of anionic polymerization, alkali or these SHIRANO rate solutions, such as tetramethylammonium hydroxide and hydroxylation n-butyl phosphonium, etc. can be used, and reaction temperature is 80-130 degrees C.
[0021] As for such hydroxyl content poly dimethylsiloxane, it is desirable that the molecular weight Mw is the thing of 10000-40000. Moreover, two or less thing has the heat-resistant viewpoint of the anisotropic conductive sheet 30 obtained to a desirable molecular-weight-distribution characteristic. In this invention, either the above-mentioned vinyl group content poly dimethylsiloxane and hydroxyl content poly dimethylsiloxane can also be used, and both can also be used together.
[0022] The curing catalyst for stiffening the high polymer formation ingredient concerned can be made to contain in a high polymer formation ingredient. As such a curing catalyst, organic peroxide, a fatty-acid azo compound, a hydrosilylation catalyst, etc. can be used. As an example of the organic peroxide used as a curing catalyst, a benzoyl peroxide, peroxidation BISUJI cyclo benzoyl, peroxidation JIKUMIRU, peroxidation JITA challis butyl, etc. are mentioned. Azobisisobutyronitril etc. is mentioned as an example of the fatty-acid azo compound used as a curing catalyst. Although it can be used as a catalyst of a hydrosilylation reaction, as an example, well-known things, such as complex of the complex of the complex of chloroplatinic acid and its salt, platinum-partial saturation radical content siloxane complex, the complex of a vinyl siloxane and platinum, platinum, and 1 and 3-divinyl tetramethyl disiloxane, the Tori ORGANO phosphine or phosphite, and platinum, an acetyl acetate platinum chelate, and annular diene and platinum, are mentioned. Although the amount of the curing catalyst used is suitably chosen in consideration of the class of high polymer formation ingredient, the class of curing catalyst, and other hardening processing conditions, it is usually 3 - 15 weight section to the high polymer formation ingredient 100 weight section.
[0023] It is desirable to use what shows magnetism from a viewpoint to which orientation of the particle concerned can be easily carried out by the approach of mentioning later as a conductive particle P which constitutes the anisotropic conductive sheet 30. As an example of a conductive particle which shows

such magnetism The particle containing the particle of the metal in which the magnetism of iron, nickel, cobalt, etc. is shown, the particles of these alloys, or these metals, These particles are made into a heart particle. On the front face of the heart particle concerned Or gold, silver, palladium, A mineral matter particle or polymer particles, such as a thing which plated conductive good metals, such as a rhodium, a non-magnetic metal particle, or a glass bead, are made into a heart particle. What covered both the conductive magnetic substance and a conductive good metal is mentioned to the thing which plated the conductive magnetic substance, such as nickel and cobalt, on the front face of the heart particle concerned, or a heart particle. In these, it is desirable to use what made the nickel particle the heart particle and plated the conductive good metal of gold, silver, etc. on the front face. Although not limited to the front face of a heart particle especially as a means to cover a conductive metal, electroless deposition can perform, for example.

[0024] When using the thing with which the front face of a heart particle comes to cover a conductive metal as a conductive particle P, it is 47 - 95% that the coverage (the covering surface product of a conductive metal to the surface area of a heart particle comparatively) of the conductive metal in the particle front face from a viewpoint on which good conductivity is acquired is 40% or more especially preferably 45% or more desirable still more preferably. Moreover, the amount of covering of a conductive metal is 4 - 20 % of the weight especially preferably 3.5 to 25% of the weight still more preferably three to 30% of the weight more preferably [it is desirable that it is 2.5 - 50% of the weight of a heart particle, and]. When the conductive metal covered is gold, as for the amount of covering, it is desirable that it is 3 - 30% of the weight of a heart particle, and it is 4 - 20 % of the weight still more preferably 3.5 to 25% of the weight more preferably. Moreover, when the conductive metal covered is silver, as for the amount of covering, it is desirable that it is 3 - 50% of the weight of a heart particle, and it is 4 - 40 % of the weight more preferably.

[0025] Moreover, 2-400 micrometers of 5-300 micrometers of particle diameter of the conductive particle P are 10-150 micrometers especially preferably still more preferably more preferably [it is desirable that it is 1-500 micrometers, and]. moreover, the particle size distribution (Dw/Dn) of the conductive particle P is 1-10 -- desirable -- more -- desirable -- 1-7 -- further -- desirable -- 1-5 -- it is 1-4 especially preferably. By using the conductive particle P with which are satisfied of such conditions, the anisotropic conductive sheet 30 obtained becomes what has easy pressurization deformation, and electric contact sufficient between the conductive particles P is acquired in the anisotropic conductive sheet 30 concerned. Moreover, although especially the configuration of the conductive particle P is not limited, it is the point which can be easily distributed in a high polymer formation ingredient, and it is desirable that it is the massive thing to depend on the secondary particle which a spherical thing, a stellate-like thing, or these condensed.

[0026] Moreover, the water content of the conductive particle P is 1% or less especially preferably 2% or less still more preferably 3% or less more preferably [it is desirable that it is 5% or less, and]. In the manufacture approach later mentioned by using the conductive particle P with which are satisfied of such conditions, in case hardening processing of the molding material layer is carried out, it is prevented or controlled that air bubbles arise in the molding material layer concerned.

[0027] Moreover, that by which the front face of the conductive particle P was processed by coupling agents, such as a silane coupling agent, can be used suitably. By processing the front face of a conductive particle by the coupling agent, the adhesive property of the conductive particle P and an elastic high polymer concerned becomes high, consequently the anisotropic conductive sheet 30 obtained becomes what has the high endurance in use of a repeat. Although the amount of the coupling agent used is suitably chosen in the range which does not affect the conductivity of the conductive particle P, it is desirable that it is the amount from which the coverage (the covering surface product of the coupling agent to the surface area of a conductive heart particle comparatively) of the coupling agent in the front face of the conductive particle P becomes 5% or more, and it is an amount from which the above-mentioned coverage becomes 20 - 100% preferably especially 10 to 100% still more preferably 7 to 100% more preferably.

[0028] As for such a conductive particle P, it is desirable to be used at a rate which becomes 15 - 50%

preferably 10 to 60% with a volume fraction to a high polymer formation ingredient. When this percentage is less than 10%, the anisotropic conductive sheet 30 with a fully small electric resistance value may not be obtained. On the other hand, when this rate exceeds 60%, the anisotropic conductive sheet 30 obtained will tend to become brittle, and elasticity required as an anisotropic conductive sheet 30 may not be acquired.

[0029] Inorganic fillers, such as the usual silica powder, colloidal silica, an aerogel silica, and an alumina, can be made to contain in a high polymer formation ingredient if needed. The thixotropy of the molding material obtained by making such an inorganic filler contain is secured, the viscosity becomes high, and moreover, while the distributed stability of the conductive particle P improves, the reinforcement of the anisotropic conductive sheet 30 which hardening processing is carried out and is obtained becomes high. Although it is not limited, since it becomes impossible to fully attain the orientation of the conductive particle by the magnetic field in the manufacture approach mentioned later not much when especially the amount of such inorganic filler used is used for a large quantity, it is not desirable.

[0030] As an ingredient which constitutes the frame plate 40, various ingredients, such as a metallic material, a ceramic ingredient, and a resin ingredient, can be used. As the example Iron, copper, nickel, chromium, cobalt, magnesium, manganese, molybdenum, An indium, lead, palladium, titanium, a tungsten, aluminum, Metallic materials, such as an alloy which combined metals, such as gold, platinum, and silver, or two or more sorts of these, or alloy steel, Although resin ingredients, such as ceramic ingredients, such as silicon nitride, silicon carbide, and an alumina, an aramid non-woven fabric reinforcement mold epoxy resin, aramid non-woven fabric reinforcement mold polyimide resin, and aramid non-woven fabric reinforcement mold bismaleimide triazine resin, are mentioned It is desirable to use the line coefficient of thermal expansion, the EQC, or the approximated thing of the ingredient which constitutes the wafer whose line coefficient of thermal expansion is a subject of examination. Especially when the ingredient which constitutes a wafer is silicon, it is desirable that a line coefficient of thermal expansion uses the thing of 3x10-6 - 8x10-6/K below 1.5x10-4/K, and, specifically, metallic materials, such as Elinver alloys, such as the Invar mold alloys, such as Invar, and elinvar, super Invar, covar, and 42 alloys, and an aramid non-woven fabric reinforcement mold organic resin ingredient are mentioned as the example.

[0031] The above contact-carrying members 20 are the followings, and can be made and manufactured. First, the molding material with which it comes to distribute the conductive particle which shows magnetism in the high polymer formation ingredient which serves as an elastic high polymer by hardening processing is prepared. And the metal mold 50 for anisotropic conductive sheet forming which has the tabular female mold 55 which consists of the tabular punch 51 and tabular ferromagnetic which consists of a ferromagnetic as shown in drawing 3 is prepared, while arranging the frame plate 40 in the cavity of this metal mold 50, the prepared molding material is applied to a field including the inside of the opening 41 in this frame plate 40, and an opening edge, and molding material layer 30A is formed in it. As a ferromagnetic which constitutes the punch 51 and female mold 55 in metal mold 50 here, ferromagnetic metals, such as iron, an iron nickel alloy, an iron-cobalt alloy, nickel, and cobalt, can be used.

[0032] Then, an parallel magnetic field is made to act in the thickness direction of molding material layer 30A by arranging the electromagnet (illustration abbreviation) of a pair on the top face of a punch 51, and the inferior surface of tongue of female mold 55, and operating the electromagnet concerned on them. Consequently, in molding material layer 30A, as the conductive particle P currently distributed in the molding material layer 30A concerned shows drawing 4 , orientation is carried out so that it may stand in a line in the thickness direction of the molding material layer 30A concerned. And in this condition, by carrying out hardening processing of the molding material layer 30A, in the opening 41 of a frame 40, where the anisotropic conductive sheet 30 is fixed to the opening edge of the frame 40 concerned, it is formed, with a contact-carrying member 20 is manufactured.

[0033] The reinforcement of the parallel magnetic field which acts above at molding material layer 30A has the desirable magnitude which becomes 0.02-2 teslas on an average. Although hardening processing

of molding material layer 30A is suitably selected with the ingredient used, it is usually performed by heat-treatment. What is necessary is just to form a heater in an electromagnet, when heating performs hardening processing of molding material layer 30A. Whenever [concrete stoving temperature], and heating time are suitably selected in consideration of the time amount which the class of high polymer formation ingredient which constitutes molding material layer 30A, and migration of the conductive particle P take. Moreover, although hardening processing of molding material layer 30A can also be performed after it stops an operation of an parallel magnetic field, it is desirable to carry out in the condition [having made the parallel magnetic field act freely].

[0034] In such wafer checking probe equipment, as it is the following, inspection of a wafer is performed. As shown in drawing 5 , it is arranged so that wafer checking probe equipment may counter above the wafer installation base 5 and a contact-carrying member 20 may counter the wafer installation base 5 concerned, it is in the condition in which the letter electrode 2 of a projection whose wafer 1 which is a subject of examination is the inspected electrode turned to the upper part on the wafer installation base 5, and it is arranged so that each of the letter electrode 2 of a projection may be located directly under [each] the inspection electrode 11 of the checking circuit board 10. Subsequently, by pressurizing the checking circuit apparatus 10 caudad by the proper pressurization means, for example, the anisotropic conductive sheet 30 in a contact-carrying member 20 contacts the letter electrode 2 of a projection of a wafer 1, and will be in the condition of having been further pressurized with the letter electrode 2 of a projection. By this, the anisotropic conductive sheet 30 deforms elastically so that it may compress in the thickness direction according to the protrusion height of the letter electrode 2 of a projection of a wafer 1. On the anisotropic conductive sheet 30 concerned Between the letter electrode 2 of a projection of a wafer 1, and the inspection electrode 11 of the checking circuit board 10, the track extended in the thickness direction of the anisotropic conductive sheet 30 concerned by the conductive particle is formed, consequently the electrical installation of the letter electrode 2 of a projection of a wafer 1 and the inspection electrode 11 of the checking circuit board 10 is attained. And a wafer 1 is heated by predetermined temperature and necessary electric inspection is performed about the wafer 1 concerned in this condition.

[0035] Since the part in contact with the letter electrode 2 of a projection of the wafer 1 in a contact-carrying member 20 is constituted by the anisotropic conductive sheet 30 which has elasticity according to above wafer checking probe equipment, the letter electrode 2 of a projection concerned is not damaged even if heated in the condition of it having been pressurized by the contact-carrying member 20, or having been pressurized. And since elastic deformation of it is carried out in the thickness direction when the anisotropic conductive sheet 30 is pressurized by the wafer 1, it can attain stably and certainly the electrical installation to the letter electrode 2 of a projection concerned also about the wafer 1 with which the letter electrode 2 of a projection of a large number which have variation in protrusion height has been arranged by high density also about the wafer 1 which big curvature produced. Furthermore, even if the anisotropic conductive sheet 30 is heated by the elevated temperature in the condition of it having been pressurized with the letter electrode 2 of a projection, or having been pressurized, in order that it may not break down easily, also when it is repeatedly used over many times, a good electrical installation condition is maintained by stability. Moreover, since it becomes unnecessary to arrange many inspection probes which consist of a pin or a blade, reduction-ization of a manufacturing cost can be attained, the checking circuit board 10 and a contact-carrying member 20 have small thickness respectively, and since stable electrical installation is moreover obtained with small welding pressure and a thing large-sized as a pressurization device becomes unnecessary, the miniaturization of the whole wafer test equipment can be attained. Moreover, since the anisotropic conductive sheet 30 is being fixed to the opening edge of the frame plate 40, even when the heat history is received, deformation of the direction of a field by thermal expansion is controlled with the frame plate 40 concerned. Also in a burn in test, a good electrical installation condition is maintainable equivalent to the line coefficient of thermal expansion of the ingredient which constitutes the wafer 1 whose line coefficient of thermal expansion is a subject of examination as an ingredient which constitutes the frame plate 40 especially, or by using what was approximated.

[0036] [Gestalt of the 2nd operation] Drawing 6 is the sectional view for explanation expanding and showing the configuration of the important section of the wafer checking probe equipment concerning the gestalt of operation of the 2nd of this invention. In this wafer checking probe equipment, the anisotropic conductive sheet 30 in a contact-carrying member 20 It has two or more track formation sections 31 extended in the thickness direction in which it comes densely to fill up the conductive particle P which shows magnetism into an insulating elastic high polymer. Each of these track formation sections 31 In the condition of having insulated mutually, it is arranged by the insulating section 32 which consists of an insulating elastic high polymer according to the pattern corresponding to the pattern of the letter electrode of a projection of the wafer which is a subject of examination. And the contact-carrying member 20 is arranged so that each of the track formation section 31 of the anisotropic conductive sheet 30 may be located on the inspection electrode 11 of the checking circuit board 10. Others are the same configurations as the gestalt of the 1st operation of the above-mentioned.
[0037] Although the path of the track formation section 31 is suitably set up according to the path of the letter electrode of a projection of the wafer which is a subject of examination, it is desirable that the electrical installation to the letter electrode of a projection is the point attained much more certainly, and is 50 - 150% of the path of the letter electrode of a projection, and it is 80 - 110% more preferably. As for the conductive particle P, it is desirable to be used into the track formation section 31 at a rate which becomes 10 - 60% with a volume fraction, and it is 15 - 50% more preferably. When this percentage is less than 10%, the track formation section 31 with a fully small electric resistance value may not be obtained. On the other hand, when this rate exceeds 60%, the track formation section 31 obtained will tend to become brittle, and elasticity required as the track formation section 31 may not be acquired.
[0038] The above contact-carrying members 20 are the followings, and can be made and manufactured. First, the molding material with which it comes to distribute the conductive particle which shows magnetism in the elastic body formation ingredient which serves as an elastic high polymer by hardening processing is prepared. And in the cavity of the metal mold 50 for anisotropic conductive sheet forming, as shown in drawing 7 , while arranging the frame plate 40, the prepared molding material is applied to a field including the inside of the opening 41 in this frame plate 40, and an opening edge, and molding material layer 30A is formed in it. In this molding material layer 30A, the conductive particle P is in the condition distributed in the molding material layer 30A concerned. Here, if metal mold 50 is explained concretely, it is arranged, this metal mold 50 is constituted so that the female mold 55 used as a punch 51 and this, and a pair may counter mutually, and the cavity is formed between the inferior surface of tongue of a punch 51, and the top face of female mold 55. the arrangement pattern of the track formation section 31 of the anisotropic conductive sheet 30 which should be manufactured on the inferior surface of tongue of the ferromagnetic substrate 52 in a punch 51 -- an opposite -- the ferromagnetic layer 53 is formed according to a **** pattern, and the non-magnetic-material layer 54 is formed in parts other than this ferromagnetic layer 53. On the other hand, in female mold 55, the ferromagnetic layer 57 is formed in the top face of the ferromagnetic substrate 56 according to the same pattern as the arrangement pattern of the track formation section 31 of the anisotropic conductive sheet 30 which should be manufactured, and the non-magnetic-material layer 58 is formed in parts other than this ferromagnetic layer 57.
[0039] As an ingredient which constitutes the ferromagnetic substrates 52 and 56 in each of a punch 51 and female mold 55, ferromagnetic metals, such as iron, an iron nickel alloy, an iron-cobalt alloy, nickel, and cobalt, can be used. It is desirable that that thickness is 0.1-50mm, these ferromagnetic substrates 52 and 56 have a smooth front face, and it is desirable that cleaning processing is carried out chemically and polish processing is carried out mechanically. Moreover, as an ingredient which constitutes the ferromagnetic layers 53 and 57 in each of a punch 51 and female mold 55, ferromagnetic metals, such as iron, an iron nickel alloy, an iron-cobalt alloy, nickel, and cobalt, can be used. As for these ferromagnetic layers 53 and 57, it is desirable that that thickness is 10 micrometers or more. If this thickness is 10 micrometers or more, the conductive particle P can be gathered at high density into the part which the magnetic field which has sufficient intensity distribution can be made to act to molding material layer 30A, consequently should serve as the track formation section 31 in the molding material

layer 30A concerned, and the track formation section 31 which has good conductivity will be obtained.
[0040] Moreover, although non-magnetic metal, such as copper, the high polymer which has thermal resistance can be used as an ingredient which constitutes the non-magnetic-material layers 54 and 58 in each of a punch 51 and female mold 55 At the point which can form the non-magnetic-material layers 54 and 58 easily by the technique of photolithography The high polymer hardened by the radiation can be used preferably, and photoresists, such as a liquefied resist of an acrylic dry film resist, the liquefied resist of an epoxy system, and a polyimide system, can be used as the ingredient, for example.
[0041] Then, arrange the electromagnet or permanent magnet of a pair on the top face of the ferromagnetic substrate 52 in a punch 51, and the inferior surface of tongue of the ferromagnetic substrate 56 in female mold 55, and molding material layer 30A is received on them. The magnetic field which has intensity distribution, i.e., the magnetic field which has larger reinforcement than the other part in the part between the ferromagnetic layer 53 of a punch 51 and the ferromagnetic layer 57 of the female mold 55 corresponding to this, is made to act in the thickness direction of molding material layer 30A. Consequently, in molding material layer 30A, as the conductive particle P currently distributed in the molding material layer 30A concerned shows drawing 8 , while gathering into the part which should serve as the track formation section 31 located between the ferromagnetic layer 53 of a punch 51, and the ferromagnetic layer 57 of the female mold 55 corresponding to this, orientation is carried out so that it may stand in a line in the thickness direction of the molding material layer 30A concerned. In this condition, molding material layer 30A and by carrying out hardening processing The track formation section 31 which it comes to contain where [which has been arranged between the ferromagnetic layer 53 of a punch 51, and the ferromagnetic layer 57 of the female mold 55 corresponding to this] orientation is carried out so that the conductive particle P may be located in a line in the thickness direction in an elastic high polymer, The anisotropic conductive sheet 30 which consists of the insulating section 32 which consists of macromolecule elastic matter which intervened among these track formation sections 31 is formed in the condition of having been fixed to the opening edge, in the opening 41 of a frame 40, with a contact-carrying member 20 is manufactured. The reinforcement of the magnetic field of which a molding material layer 30A operation is done above has the desirable magnitude which becomes 0.02-2 teslas on an average between the ferromagnetic layer 53 of a punch 51, and the ferromagnetic layer 57 of the female mold 55 corresponding to this.
[0042] While the same effectiveness as the wafer checking probe equipment concerning the gestalt of the 1st operation of the above-mentioned is acquired according to such wafer checking probe equipment Since the track formation section 31 of a large number arranged corresponding to the letter electrode of a projection of a wafer is formed after the insulating section 32 has insulated mutually, the adjoining letter of projection inter-electrode insulation is maintained certainly, consequently a necessary electrical installation condition is acquired much more certainly.
[0043] [Gestalt of the 3rd operation] Drawing 9 is the sectional view for explanation showing the configuration of the wafer checking probe equipment concerning the gestalt of operation of the 3rd of this invention. In this wafer checking probe equipment, a contact-carrying member 20 has the frame plate 40 with which two or more openings 41 were formed, and the anisotropic conductive sheet 30 is arranged at each of these openings 41. The opening 41 of the frame plate 40 is formed for every integrated circuit in the wafer which is a subject of examination, as shown also in drawing 10 . The thing same as an ingredient which constitutes the frame plate 40 as the gestalt of the 1st operation of the above-mentioned can be used. The anisotropic conductive sheet 30 in a contact-carrying member 20 Even if it comes to contain where orientation is carried out so that the thing P of a configuration of being shown in drawing 2 , i.e., a conductive particle, may be located in a line in the thickness direction over the whole surface of a sheet The thing P of a configuration of being shown in drawing 6 , i.e., a conductive particle, may consist of the track formation section of a large number extended in the thickness direction contained densely, and the insulating section which intervened among these track formation sections.
[0044] Since two or more openings 41 are formed in the frame 40 for every integrated circuit in a wafer and the anisotropic conductive sheet 30 is arranged at each of the opening 41 concerned while the same

effectiveness as the wafer checking probe equipment concerning the gestalt of the 1st operation of the above-mentioned is acquired according to such wafer checking probe equipment, area is easy to be small [the anisotropic conductive sheet 30 concerned]. Therefore, since there is little absolute magnitude of the thermal expansion in each direction of a field of the anisotropic conductive sheet 30 even when the heat history is received, a good electrical installation condition is maintainable to stability also to the wafer of a large area.

[0045] [Gestalt of the 4th operation] Drawing 11 is the sectional view for explanation expanding and showing the configuration of the important section of the wafer checking probe equipment concerning the gestalt of operation of the 4th of this invention. In this wafer checking probe equipment, the conductive rigid layer 35 is formed in the front face of the track formation section 31 of the anisotropic conductive sheet 30 in a contact-carrying member 20 in one. The configuration of others in the anisotropic conductive sheet 30 is the same as that of the gestalt of the 2nd operation of the above-mentioned. Moreover, even if it comes to form one opening 41 in the center section except the thing, i.e., the periphery section, of a configuration of being shown in drawing 1 as a frame plate 40, you may come to form two or more openings 41 for every integrated circuit in the wafer which is the thing of a configuration of being shown in drawing 9 , i.e., a subject of examination.

[0046] As a conductive rigid layer 35, a metal layer or a conductive organic material layer can be used. As an ingredient which constitutes a metal layer, copper, gold, a rhodium, platinum, palladium, nickel, or these alloys can be used, and it may be formed of the layered product of a different metal as a metal layer. As an ingredient which constitutes a conductive organic material layer, the thing which addition-of-conductivity matter, such as metal powder or carbon black, comes to contain can be used into resin ingredients, such as an epoxy resin. The thickness of the conductive rigid layer 35 is 5-500 micrometers, and is 20-100 micrometers preferably. As the formation approach of such a conductive rigid layer 35, when the conductive rigid layer 35 concerned is a metal layer, the approach of forming in the front face of the track formation section 31 alternatively, the approach of carrying out photo etching processing of the metal layer formed all over the front face of the anisotropic conductive sheet 30, etc. can be used by photolithography and plating processing. Moreover, when the conductive rigid layer 35 concerned is a conductive organic material layer, the approach of applying to the front face of the track formation section 31 the ingredient which the addition-of-conductivity matter comes to contain in a liquefied hardenability resin ingredient, and hardening it can be used.

[0047] Since according to such wafer checking probe equipment the conductive rigid layer 35 is formed in the front face of the track formation section 31 in the anisotropic conductive sheet 30 while the same effectiveness as the gestalt of the 1st operation of the above-mentioned and the gestalt of the 2nd operation is acquired, the electrical installation further stabilized to the letter electrode of a projection of the wafer which is a subject of examination is obtained. Moreover, since the oxide film concerned can be broken through by the conductive rigid layer 35 concerned also when the oxide film is formed in the front face of the letter electrode of a projection of the wafer which is a subject of examination, necessary electrical installation can be attained certainly. Furthermore, in order that the track formation section 31 formed of the elastic high polymer may not contact directly, the letter electrode of a projection is not polluted by the letter electrode of a projection of the wafer which is a subject of examination by the low molecular weight constituent contained in the elastic high polymer which constitutes the track formation section 31 concerned.

[0048]

[Effect of the Invention] Since the part in contact with the inspected electrode of the wafer in a contact-carrying member is constituted by the anisotropic conductive sheet which has elasticity according to the wafer checking probe equipment of this invention, the inspected electrode concerned is not damaged even if heated in the condition of it having been pressurized by the contact-carrying member or having been pressurized. And since elastic deformation of it is carried out in the thickness direction when an anisotropic conductive sheet is pressurized by the wafer, it can attain stably and certainly the electrical installation to the letter electrode of a projection concerned also about the wafer with which the letter electrode of a projection of a large number which project also about the wafer which big curvature

produced when an inspected electrode is a letter electrode of a projection, and have variation in height has been arranged by high density. Furthermore, even if an anisotropic conductive sheet is heated by the elevated temperature in the condition of it having been pressurized with the letter electrode of a projection, or having been pressurized, in order that it may not break down easily, also when it is repeatedly used over many times, a good electrical installation condition is maintained by stability. Moreover, since it becomes unnecessary to arrange many inspection probes which consist of a pin or a blade, reduction-ization of a manufacturing cost can be attained, the checking circuit board and a contact-carrying member have small thickness respectively, and since stable electrical installation is moreover obtained with small welding pressure and a thing large-sized as a pressurization device becomes unnecessary, the miniaturization of the whole wafer test equipment can be attained.

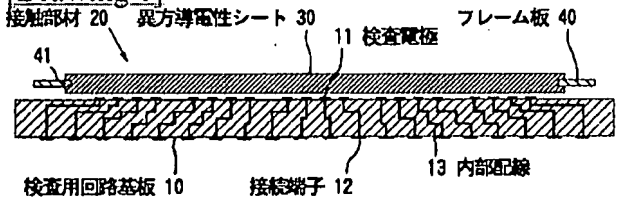
[Translation done.]

* NOTICES *

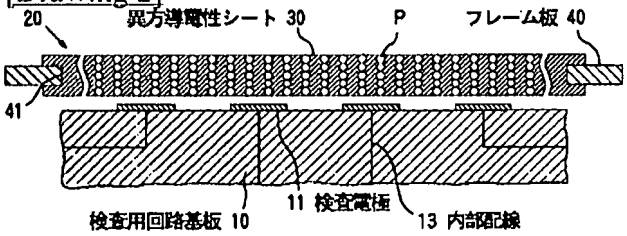
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

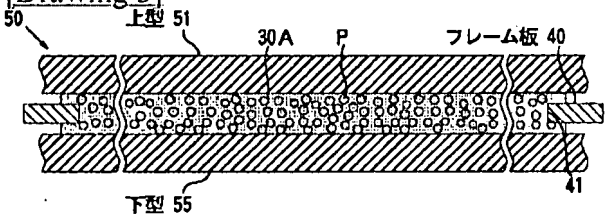
[Drawing 1]



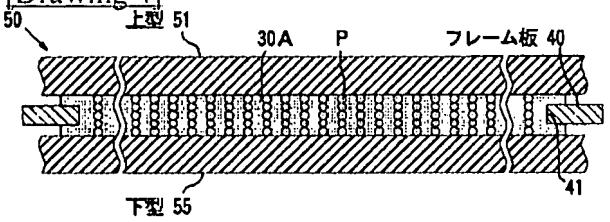
[Drawing 2]



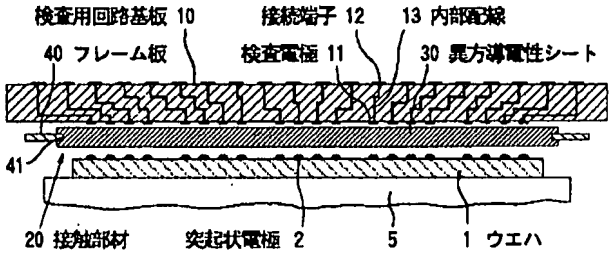
[Drawing 3]



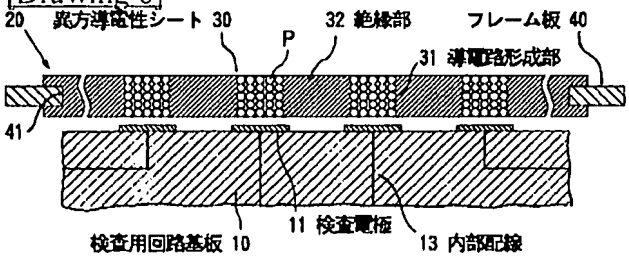
[Drawing 4]



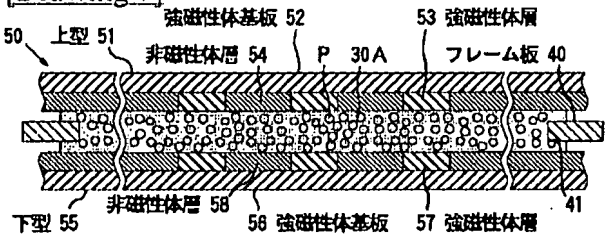
[Drawing 5]



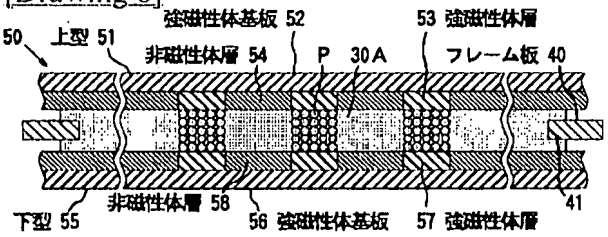
[Drawing 6]



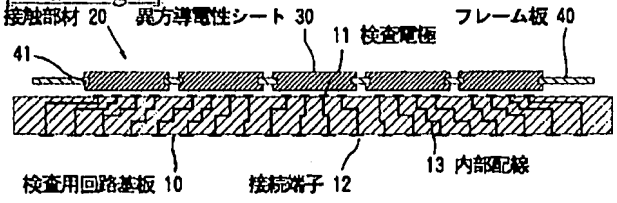
[Drawing 7]



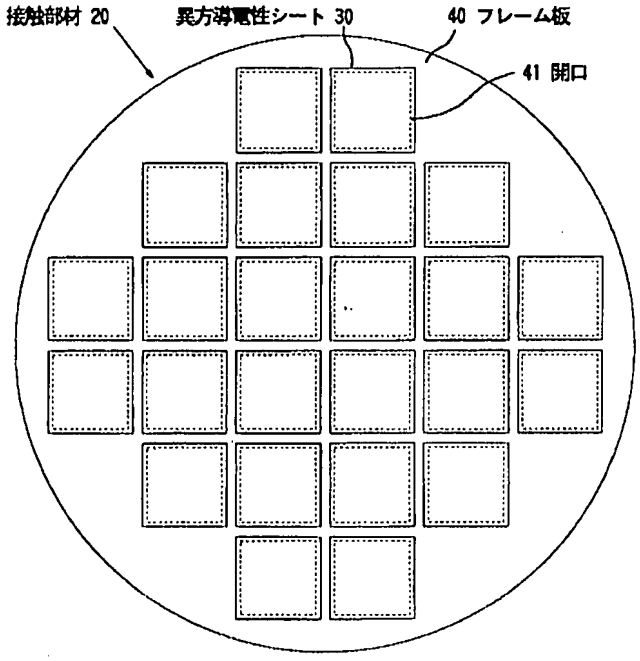
[Drawing 8]



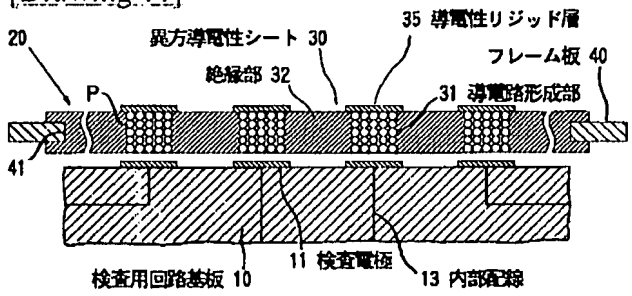
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]